

No. 720,125.

PATENTED FEB. 10, 1903.

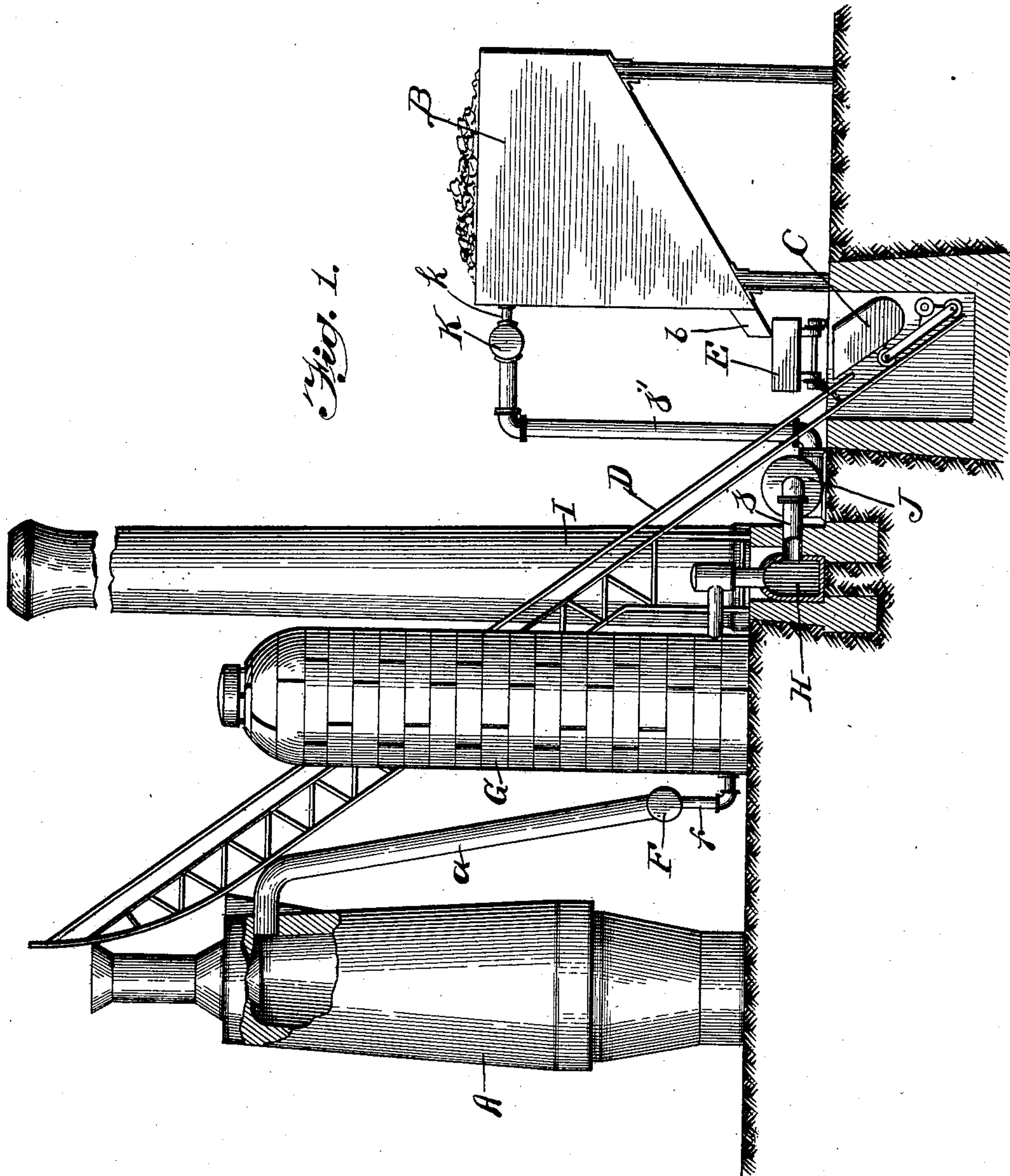
F. H. FOOTE & T. W. ROBINSON.

FURNACE APPARATUS.

APPLICATION FILED APR. 5, 1902.

NO MODEL.

3 SHEETS—SHEET 1.



Witnesses:

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*Robert H. Weir*

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*Theodore W. Robinson*

*By Chas. C. Bulkley atty.*

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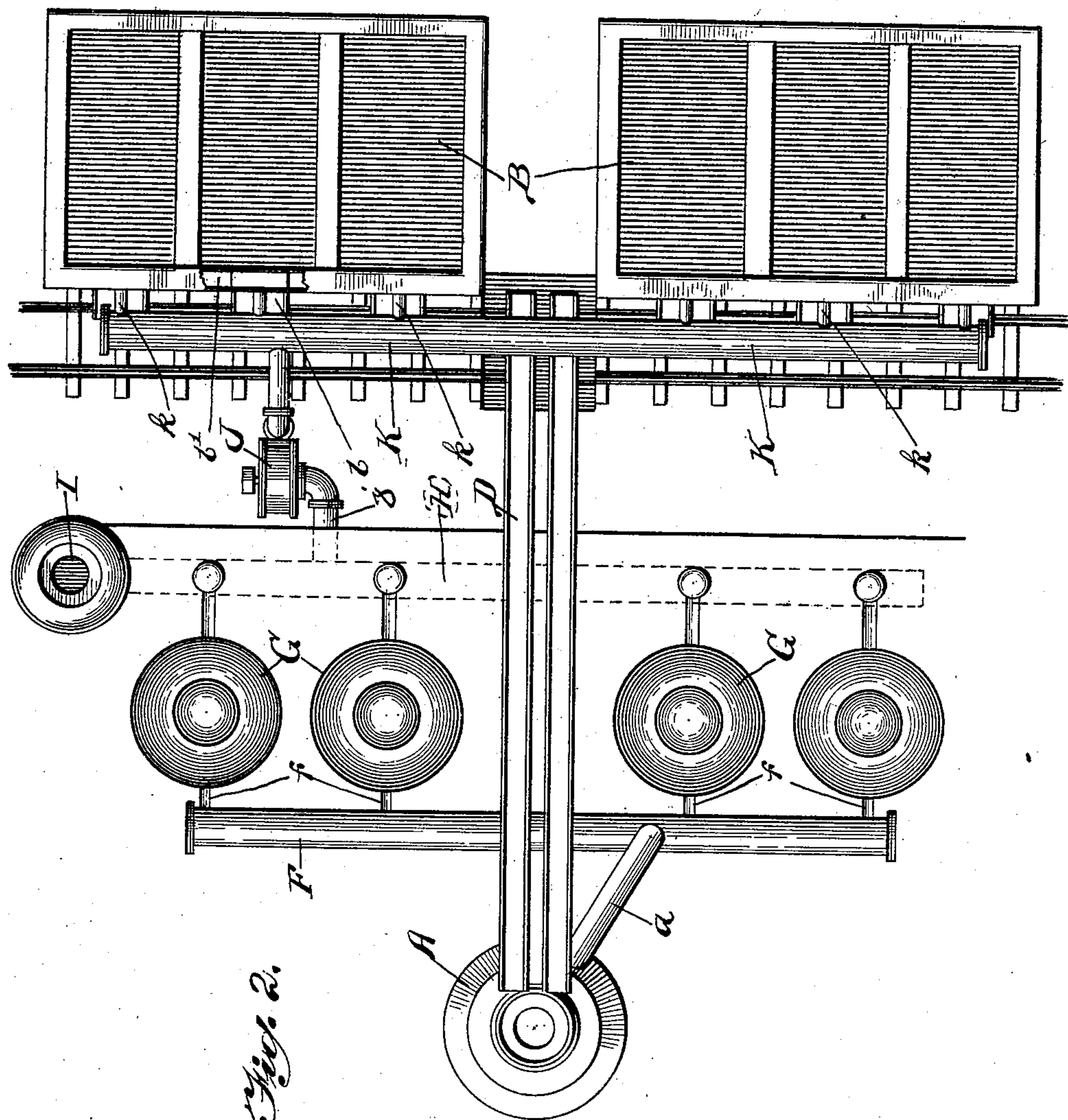
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## FURNACE APPARATUS.

APPLICATION FILED APR. 5, 1902.

NO MODEL.

3 SHEETS—SHEET 2.



May 2.

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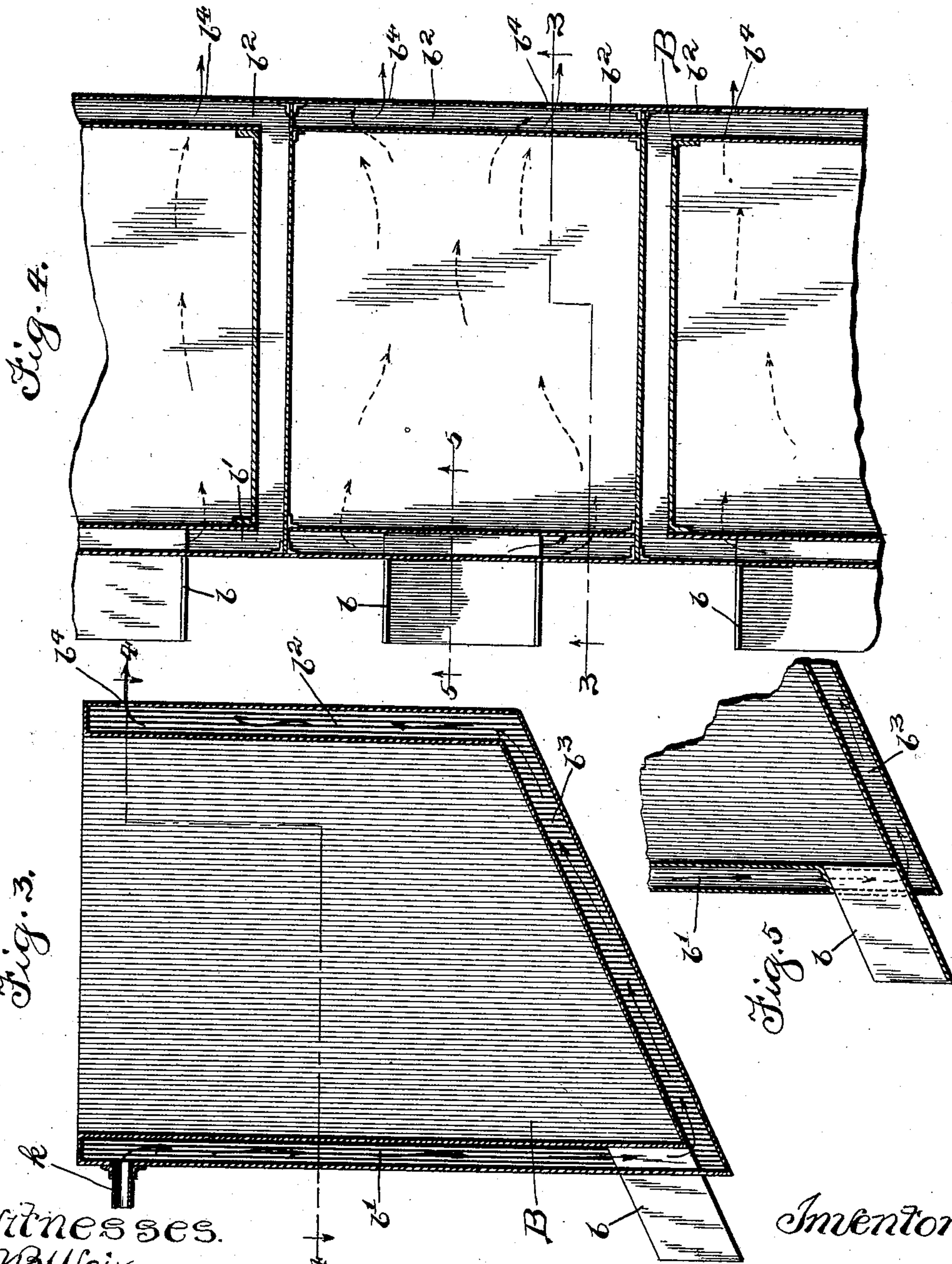
F. H. FOOTE & T. W. ROBINSON.

FURNACE APPARATUS.

APPLICATION FILED APR. 5, 1902.

NO MODEL.

3 SHEETS—SHEET 3.



Witnesses.  
J. B. Weir  
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By Chas. B. Bulkeley, Atty.



# UNITED STATES PATENT OFFICE.

FREDERICK H. FOOTE AND THEODORE W. ROBINSON, OF CHICAGO,  
ILLINOIS.

## FURNACE APPARATUS.

SPECIFICATION forming part of Letters Patent No. 720,125, dated February 10, 1903.

Application filed April 5, 1902. Serial No. 101,458. (No model.)

*To all whom it may concern:*

Be it known that we, FREDERICK H. FOOTE and THEODORE W. ROBINSON, citizens of the United States of America, and residents of Chicago, Cook county, Illinois, have invented certain new and useful Improvements in Furnace Apparatus, of which the following is a specification.

Our invention contemplates an improvement in ore-handling apparatus designed more particularly for use in connection with furnaces. In the reduction of iron ore, for example, it is generally the practice to provide bins for holding the ore and to also provide suitable conveying apparatus for carrying the ore from these bins to the top of the furnace. With an arrangement of this character more or less difficulty is experienced in securing a free discharge of the ore from the bins into the conveying apparatus, especially in cold weather. At such time the ore is likely to freeze and adhere to the sides of the bins and to clog the spouts or discharge-openings through which the ore is conducted to the apparatus for conveying it to the top of the furnace. This prevents a free discharge of the ore from the bins, and consequently interferes with the operation of the furnace.

Generally stated, it is therefore the object of our invention to provide a simple arrangement for insuring at all times a free and unrestricted discharge of ore from the bins.

A special object of our invention is to provide a construction and arrangement whereby heated gases may be conveniently employed for heating the bins. To such ends our invention contemplates an arrangement involving ore-bins provided with heating-jackets whereby the bins may be heated and the ore prevented from freezing. It also contemplates an arrangement whereby the products of combustion resulting from the burning of the gases generated in the furnace may be conducted to the said jackets, and thus employed for heating the bins.

Referring to the accompanying drawings, Figure 1 illustrates a furnace and an ore-handling apparatus embodying the principles of our invention. Fig. 2 is a plan of the furnace and apparatus shown in Fig. 1. Fig. 3 is a vertical transverse section through one

of the bins. Fig. 4 is a horizontal section on line 4 4 in Fig. 3. Fig. 5 is a detail section through the front wall of one of the bins and also through one of the spouts on line 5 5 in Fig. 4.

It will be readily understood that the furnace A can be of any suitable form or character and can be constructed and operated in the usual manner. The ore-bins B are preferably associated with the said furnace in such manner as to permit the ore to be readily transferred to the latter. For example, the conveyer C can be arranged to travel on ways D, which latter are arranged to extend from the bottom of the bins to the top of the furnace. With this arrangement the ore is discharged from the bin-spout *b* into the car E and is then transferred from the latter to the said conveyer C. In this way the ore is stored or held in bins and transferred in suitable quantities to the furnace. It will be readily understood that the conveying apparatus thus illustrated can be constructed and operated in any suitable manner. As a simple and effective arrangement for keeping the bins warm, so as to prevent the ore from freezing in cold weather, the various walls of the same can be made double, so as to provide the bins with jackets. For example, in Figs. 3, 4, and 5 the bins are constructed with front and back chambers or spaces *b'* *b*<sup>2</sup> and also with a bottom space or chamber *b*<sup>3</sup>. In this way the bin structure is provided with a hollow jacket into which heated gases can be conducted for the purpose of keeping the bins warm and preventing the ore from freezing together or adhering to the sides of the bin. The heated gases for this purpose can be supplied from any suitable source and can be conducted through the heating-jackets in the direction indicated by the arrows. It will be understood that a free flow and circulation of these heated gases can be secured by providing the jacket with vent-openings *b*<sup>4</sup>. As a matter of further and special improvement this heating-jacket is preferably supplied with the products of combustion by burning the gases generated in the furnace. For example, the said furnace can be provided with the usual offtake pipe or flue *a*, arranged to lead downwardly from the top of the furnace



to the horizontally-disposed header F. This header may be connected with the usual stoves G through the medium of the pipes *f*. The gases conducted from the furnace to these stoves are burned in the latter in the usual and well-known manner, and the products of combustion are then conducted to the smoke-flue H. From this smoke-flue the products of combustion are then allowed to escape upwardly through the stack I. A certain portion of the products of combustion is, however, drawn from the flue H and conducted through the jackets of the ore-bins. This can be accomplished in any suitable manner—as, for example, by connecting the intake *j* of the fan J with the flue H and by connecting the offtake *j'* of the fan with the horizontally-disposed header K. The different compartments of the heating-jackets of the bins can be connected with this header K through the pipes *k*. In this way the ore is, as stated, held in the bins and transferred in suitable quantities to the furnace. The gases generated by the reduction of the ore are then conducted to the stove G, where they are burned in any suitable manner. The resulting products of combustion are drawn off and allowed to escape, partly through the smoke-flue H and stack I and partly through the fan and pipes, and finally through the heating-jackets of the bins and out through the vent-openings *b*<sup>4</sup>. In this way the ore in the bins is prevented from freezing and a free discharge of ore from the bins is insured at all times. Furthermore, the products of combustion are utilized for a useful purpose.

What we claim as our invention is—

1. The combination of a furnace, an ore-bin associated with said furnace, a conveyer constructed and arranged to receive the ore from said bin and convey the same to the top of said furnace, a stove associated with said furnace, an offtake-flue connected and arranged to conduct the combustible gases from the top of the furnace to the lower portion of said stove, a heating-jacket for said bin, and connecting flues and passages for conveying the products of combustion from said stove to said jacket.

2. The combination of a furnace, a plurality of ore-bins associated with said furnace, heating-jackets for said bins, conveying apparatus connected and arranged to transfer suitable quantities of ore from said bins to the top of said furnace, a plurality of combustion-chambers arranged intermediate of said furnace and said bins, an offtake-flue connected and arranged to conduct the combustible gases from the top of said furnace to said combustion-chambers, a horizontally-disposed flue connected and arranged to receive the products of combustion from the said combustion-chambers, a stack communicating with said horizontally-disposed flue, and draft-producing means connected and arranged to draw products of combustion from said horizon-

tally-disposed flue and cause the same to pass through the heating-jackets of said bins, said jackets being provided with vent-openings for permitting the escape of the products of combustion.

3. In an apparatus for handling ores, metals, or other substances to be treated by a furnace, a bin having a plurality of compartments, a heating-jacket for said bin divided into compartments, a header connected with said jacket-compartments, a combustion-chamber, a fan or blower having its intake connected with said combustion-chamber and its offtake connected with said header, each jacket-compartment being provided with a vent-opening.

4. The combination of a furnace, an ore-bin having a heating-chamber, a suitable fan or blower, a flue connecting the said heating-chamber with the offtake of said fan, and a flue connecting the intake of said fan with said furnace.

5. Apparatus for treating ore or other materials, comprising a suitable receptacle constructed with a heating-jacket, a furnace, a conveyer arranged to transfer suitable quantities of the ore or other material from the said receptacle to the said furnace, a suitable combustion-chamber, a smoke-flue connecting said chamber with said jacket, and draft-producing means connected and arranged to draw the heated smoke and products of combustion through said flue from said chamber, and adapted to cause the same to pass through said jacket.

6. Apparatus for treating ore or other materials, comprising a receptacle provided with a heating-jacket, a combustion-chamber and means for burning fuel therein, an offtake-flue arranged to conduct the smoke and non-inflammable products of combustion to said jacket, so as to heat the ore or other material held in said receptacle, and suitable draft-producing means arranged to cause the said smoke and non-inflammable products of combustion to pass through said chamber.

7. Apparatus for treating ore or other material, comprising a suitable furnace, a receptacle adapted to hold ore or other material and provided with a heating-jacket, a stove associated with said furnace and adapted to receive and burn the combustible gases generated in the latter, an offtake-flue arranged to conduct the smoke and products of combustion from said stove to said jacket, so as to heat any materials held in said receptacle, and draft-producing means adapted to cause the smoke and products of combustion to pass through said jacket.

8. Apparatus for treating ore or other materials, comprising a combustion-chamber and means for burning fuel therein, a receptacle provided with a heating-jacket, a fan or blower having its intake connected with said combustion-chamber, and having its offtake connected with said jacket, whereby the smoke and products of combustion drawn



from said chamber are utilized for heating any materials which are held in said receptacle.

5 9. The combination of a furnace, a plurality of stoves associated with said furnace and adapted to receive and burn the combustible gases generated in the latter, a flue arranged to receive the products of combustion from all said stoves, an ore-bin provided  
10 with a heating-jacket, suitable connection between said jacket and said flue, a conveyer for transferring suitable quantities of the ore from said bin to said furnace, and a stack connected and arranged for causing a draft  
15 through said flue from said stoves.

10 10. Apparatus for reducing ore, comprising a suitable furnace, a plurality of stoves, a header connecting said stoves with said furnace, a flue connected with all said stoves, a  
20 plurality of bins provided with heating-jackets, a header connected with said jackets, suitable pipe connection between said flue and said last-mentioned header, and draft-producing means connected and arranged for  
25 drawing the products of combustion from said stoves and causing the same to pass through said jackets.

11. Apparatus for treating ores or other ma-

terials, comprising a receptacle constructed with a heating-jacket, a combustion-chamber 30 for supplying smoke and heated gases, said chamber being located at a point more or less remote from said jacket, and a flue or pipe for conducting said smoke and gases to said jacket, whereby the said smoke and heated 35 gases are utilized for heating the walls of said receptacle.

12. Apparatus for treating ore or other material, comprising a suitable receptacle constructed with a heating-jacket, means for 40 generating heated gases, said means being located at a point more or less remote from said jacket, and a flue or pipe for conducting said heated gases to said jacket, whereby the said gases may be utilized for heating any 45 material held in said receptacle.

Signed by us at Chicago, Cook county, Illinois, this 31st day of March, 1902.

FREDK. H. FOOTE.

THEODORE W. ROBINSON.

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